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Coupling thermal mass and water systems as urban passive design in hot climates (Article)

Kassim, P.S.J., Latip, N.S.A., Fauzi, M.K.B.M.

Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia, Kuala Lumpur, Malaysia

Abstract

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The impact of water in buildings is studied as a combination of vertical walls and horizontal pools that creates a combined passive cooling system for public spaces in hot climates. The paper draws from traditional water-based systems principles and forms in Mughal architecture, with the aim of studying its thermal cooling impact using CFD. Due to rapid urbanization in cities, there is a heightened demand for cool, dry comfort yet energy use can be saved by focusing on the cooling of workplace spaces while public areas are naturally cooled to reduce the carbon lock-in effects of cities. Selected sections of 16th and 17th century Mughal complexes are analysed in terms of its combination of both thermal mass (thick, high density walls), water pools, water walls and channels. The study initially looks at water to ground ratios of different Mughal gardens and enclosed courtyards, the overall integration of pools, channels, and water walls in past forms. More importantly, it analyses the impact of the coupling of thermal mass and water elements in a passive system within an infrastructure to achieve almost zero reliance of non-renewable energy for its public areas.

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Kassim, P.S.J.; Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia, Kuala Lumpur, Malaysia; email:puterishr@iium.edu.my

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